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How Price Plans Affect
Seasonality of Milk Deliveries
from Farms

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INTRODUCTION

This bulletin comprises two time-series analyses of milk deliveries to city markets. The first study[1] included 10 Ohio markets and Chicago. Chicago was included to have for comparison a large city market outside Ohio but with similar production and marketing conditions. The second study[2] was a more detailed analysis of four Ohio markets with special reference to the influence of price plans upon the deliveries of 100 dairy farmers who had sold milk to one of these markets each month for 20 years.

Seasonality of milk deliveries is of concern to both producers and distributors. In general, producers are willing to strive for more uniform month-to-month deliveries if they benefit in total returns for the year. Cooperative producer associations have generally supported incentive price plans designed to reduce spring and increase fall milk deliveries of their members.

Milk distributors are concerned because a supply with small seasonal variation means the plant needs fewer producers, physical equipment can be used to the best advantage, and there is less danger that receipts in the low production months will fall short of sales requirements.

Throughout both studies, producers, cooperatives and distributors cooperated in furnishing needed data. Interviews were used to supplement conclusions reached by statistical analysis.

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[1]This study was presented to the Graduate School of The Ohio State University by R. G. McCort in partial fulfillment of the requirements for the degree of Master of Science in 1946.

[2]The data here presented is a condensation of a dissertation presented by A. R. Conley to the Graduate School of The Ohio State University as partial fulfillment of the requirements for the degree of Doctor of Philosophy in 1949.

MILK DELIVERIES IN 10 OHIO MARKETS AND CHICAGO, 1935-1944

Purpose of this study was to determine the amount of seasonal variation in milk deliveries and to measure the extent of change during the 10-year period. A secondary purpose was to determine the change in quantity of deliveries and variation within the markets.

Farm deliveries steadily increased in size during the 10-year period (Table 1). Chicago had, in 1935, approximately double the size of deliveries of the 10 Ohio markets and held this relationship throughout the 10 years. Largest increases in the Ohio markets were in Akron, Portsmouth, East Liverpool and Toledo, and the smallest in Youngstown, Columbus and Cincinnati. The range was from 28 percent in Youngstown to 75 percent in Akron.

TABLE 1.—Average Daily Deliveries of Milk of All Producers, Chicago and 10 Ohio Markets, 1935-1944

(In Pounds)

Market	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944
Chicago	256	275	305	310	309	336	362	369	342	384
Cleveland	140	162	166	167	179	187	191	210	208	217
Youngstown	115	114	117	119	127	133	140	145	137	147
East Liverpool	114	122	130	134	134	158	174	191	179	195
Canton	134	144	153	159	160	170	183	194	194	210
Akron	114	120	133	137	142	154	179	186	191	200
Toledo	103	116	115	127	140	148	153	158	156	163
Columbus	155	153	166	162	167	171	181	202	198	203
Portsmouth	128	152	160	175	191	193	202	213	213	216
Dayton	106	108	117	125	124	128	145	162	153	155
Cincinnati	107	109	112	126	127	124	131	140	139	146

Because of this changing volume of daily deliveries, it was necessary to remove from the data the effect of secular trend before measuring changes in seasonality. The least squares method was used to measure secular trend. The seasonal index was then calculated by the ordinate-to-trend method and a 10-year average monthly index was computed by calculating a link relative of the 10-year averages of each month.

When the seasonal indices of all the markets are compared in Table 2, it is found that all the indices during November fall within the narrow range of 77.5 to 91.1. As daily average deliveries increase from winter to spring, this range becomes wider until June when the high market, Youngstown, has an index of 133.3 and the low, Portsmouth, 108.5. This is a range of 25 index points as compared with 13.5 in November. Among these 11 markets, there is greater variation of monthly deliveries in the period of heavy milk production than in November.

TABLE 2.—Seasonal Index of Milk Deliveries, Chicago and 10 Ohio Markets, 1935-1944
(Average Daily Delivery Corrected for Trend=100)

Market	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Chicago	99.43	102.90	106.51	108.67	117.25	117.91	101.67	94.95	89.13	85.80	83.12	93.12
Cleveland	91.91	95.21	100.29	107.42	127.01	126.91	106.02	97.19	94.30	87.07	81.64	85.02
Youngstown	86.52	90.98	98.99	108.76	133.10	133.30	113.60	99.87	93.61	82.36	77.53	81.34
East Liverpool	93.19	97.00	101.69	105.98	124.22	115.83	104.74	97.27	95.27	87.18	84.78	87.69
Canton	91.47	94.76	100.12	108.06	123.10	122.50	105.35	101.13	96.85	87.73	82.62	86.31
Akron	92.90	96.34	99.19	105.06	119.83	118.00	104.25	99.91	97.30	92.14	85.74	89.30
Toledo	96.36	101.04	105.07	110.16	120.93	119.77	101.91	95.39	90.57	85.02	83.73	90.04
Columbus	92.52	96.26	98.51	103.64	121.65	121.00	108.48	100.41	96.09	89.34	83.91	88.20
Portsmouth	96.53	98.00	99.80	101.90	109.97	108.51	104.93	103.19	98.93	91.93	91.09	95.19
Dayton	88.07	92.89	97.92	104.80	123.05	122.61	109.63	104.66	99.05	88.98	82.86	85.38
Cincinnati	88.75	92.69	97.81	106.74	124.95	121.91	111.71	105.06	97.52	86.86	81.63	85.03

If May and June are considered together to cover the period of high deliveries, there is only one Ohio market in the McCort study, Portsmouth, that has as narrow index range as Chicago. While not noted in this study, it is a matter of fact that in the operation of base and surplus plans these were the only 2 markets in the 11 that permitted producers to buy and sell individual bases within the market areas.

In the operation of the market plan to influence seasonality of milk deliveries, shifts in the seasonal pattern may result from changes in the period of heavy market receipts, of low receipts, or in both. If the need for changing the pattern results from burdensome surpluses in the flush months, a decline in spring deliveries with little or no change in the fall would be desirable. If, on the other hand, the market was short of bottle milk and cream in the fall, the desired emphasis would be on an increase in fall deliveries.

An analysis was made to show the spring and fall seasonal trends of deliveries in the 11 markets during the 10 years, 1935-1944. Normal changes registered in each of the seasons are shown in Table 3. For the

TABLE 3.—Normal Annual Change in Spring and Fall Average Daily Deliveries in Relation to Trend of Annual Average Daily Deliveries, Chicago and 10 Ohio Markets, 1935-1944

Market	Change in Ratio	
	Spring	Fall
Chicago	1.2738	—1.0278
Cleveland	—0.2310	0.1592
Youngstown	—0.2146	0.0186
East Liverpool	—1.1450	0.1928
Canton	0.0728	—0.0698
Akron	—0.2938	0.2728
Toledo	—0.0512	—0.0318
Columbus	0.1878	—0.0890
Portsmouth	0.7314	—0.5828
Dayton	0.1266	—0.0132
Cincinnati	0.2410	—0.6856

When the figures in Table 3 are preceded by a minus sign, it shows that the average daily delivery for such season has decreased during the 10-year period in relation to the general trend of the annual average daily delivery for the 10 years. If no sign precedes a figure, it shows a comparative increase.

spring delivery season, there were six markets that showed a positive ratio indicating relatively heavier deliveries—Chicago, Canton, Cincinnati, Columbus, Dayton and Portsmouth. The remainder showed decreasing trends. Only four markets showed a positive index in respect to performance in the light fall delivery period. These were, in order of size of index, Akron, East Liverpool, Cleveland and Youngstown.

As stated before, these computations were for trends covering the entire 10-year period. No attempt is made at any time to compare any single year with another or with the average for the 10 years. There was some shift of market conditions with the changing economic picture during the 10 years. In the early years, some markets were concerned about heavy surpluses in the spring months, whereas, by the end of the period, some markets were running short of fall requirements. The time range was too short, however, to show statistically the effect of those changes.

PRICE PLANS AND MILK DELIVERIES IN FOUR OHIO MARKETS, 1927-1946

This phase of the research deals with milk deliveries from farms to milk distributors or handlers selling fresh fluid milk and cream. The objective was to measure the effect of pricing plans upon the seasonal pattern of these milk deliveries. The research was confined to milk distributing plants because it is mainly in this field that pricing plans have been devised to influence seasonality of milk deliveries.

The four markets, Cincinnati, Columbus, Dayton and Stark County, were selected because they met two important requirements. It was possible to obtain delivery records covering a period of 20 years, and each of the markets had operated a part of the 20 years under a base plan. Since the plans were introduced and discontinued at different times, it was possible to make significant relative comparisons.

Scope of the Statistical Analysis

No attempt was made to measure the influence of all factors that might affect the seasonality of milk deliveries from farms, only to isolate and measure effect of the price plan. Seasonality of milk delivery also may be affected by weather, availability of feeds, disease in the herds and other factors.

This study deals with milk delivered from farms to city markets, and not the seasonality of milk production. Milk production and milk deliveries are not always the same. Under certain circumstances, a greater percentage than normal of the milk produced will be retained on the farm for family consumption and feeding purposes.

The entire period of the base and surplus plan represented a period during which an organized attempt was made to bring about a change in the pattern of seasonal delivery of milk. There were several modifications of the base and surplus plans. From the analytical approach, these modifications are of minor importance when comparing the period during which the market operated with a plan and the period during which the market operated free of a plan.

The period when the market operated free of a seasonal incentive plan was used as a standard for measuring the success the base plan had in changing the seasonal pattern of milk deliveries. Because of the nature of milk production there is a limit to the change that can be expected. In adjusting seasonality, the law of diminishing returns will apply and at some point in the operation change will come at a decreasing rate. For example, a market with a ratio of fall deliveries equal to 60 percent of spring deliveries would find it easier to change from 60 to 70 percent than to make a further adjustment so that fall deliveries would be 80 percent of the spring average.

A comparison of absolute changes within each market is omitted from the analysis. Attention is devoted to the study of relative changes. To ascertain whether a change in seasonal pattern of milk deliveries for a given market can be attributed to the introduction or discontinuance of the base plan, it is necessary to compare the seasonal pattern of the specific market with the change or the lack of change in seasonal pattern of milk deliveries in similar markets which were not in the process of introducing or discontinuing the price plan during the same period. Figure 1 shows the years the base plan was in operation for each of the four markets studied. During a few years, the base plan was in operation in all four markets, and there were a few years when the base plan was not in operation in any of them.

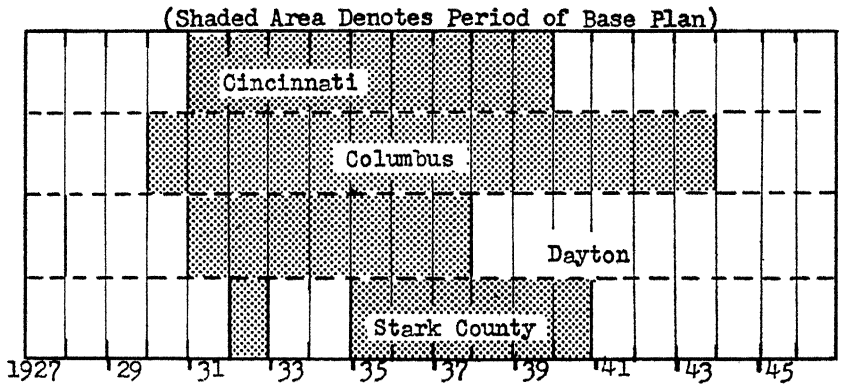

Fig. 1.—Period of the base plan and period of no base plan, four Ohio markets, 1927-46*

*The base plan is considered as being in operation during a particular year if individual bases have been established for such year.

The change as between years must be isolated and removed before an attempt is made to analyze or compare seasonal changes. For example, the average number of pounds of milk delivered each day of the year by the average shipper in the Dayton market was 56 pounds in 1927, whereas 20 years later it was 196, or an increase of 140 pounds per day. This effect of 140 pounds per day increase must be removed before an attempt is made to analyze or compare the seasonal change.

The change between years is referred to as secular trend and incidental. The least-squares method was used throughout the study to measure secular trend. To adjust for incidental, the ratio of fall-to-spring milk deliveries was computed by dividing the average daily pounds (adjusted for secular trend) of milk deliveries during the months of November and December by the average daily pounds (adjusted for secular trend) of milk delivered during the preceding and the following May and June. The years, 1934 and 1936, years of extreme drought, are examples of incidental changes.

The purpose is to analyze the relationship of the fall to spring deliveries which can be considered the seasonal pattern of deliveries. It was found the comparison could be limited to an analysis of the performance during the spring months, May and June, and the fall months, November and December, of each year. The relationship of the size of delivery as between November-December and May-June is designated the "ratio of fall-to-spring" milk deliveries.

The pattern of seasonal delivery of milk is analyzed from three standpoints as follows: Total amount of milk delivered to the market by all shippers; amount of milk delivered by the average shipper in the market, and amount of milk delivered by 100 shippers who have delivered milk continuously to the same market for a period of 20 years.

Typical Background of a Price Plan

Investigation disclosed that conditions bringing forth the introduction or the discontinuance of a pricing plan usually exist a considerable time prior to the actual introduction or discontinuance of the plan. During this waiting period for action, it is reasonable to believe that the conditions, themselves, force a certain amount of adjustment. This reduces the degree of change actually taking place immediately following the introduction or discontinuance of the plan.

Evidence to support the above conclusion was found in annual reports of the Stark County Milk Producers' Association. In 1928, the board of directors discussed the problem of surplus milk at three meetings, but no definite action was taken. In 1929, a committee on production control recommended "that the high point of production for any

producer throughout the year shall not exceed three times his low point of production and that any amount produced in excess of this be paid for at the class II price." Further committee study followed, and, in 1932, a base and surplus plan went into effect. Producers were encouraged to ship surplus milk to cheese factories.

The chaotic market condition brought so many surplus milk problems that the plan was discontinued in 1933 and 1934. Producers were then advised to choose between cheese factories and the city market for all milk to be sold. In 1935, the base surplus plan again was put into operation.

Amount of surplus milk in the Stark County market during the spring months can be considered as the major condition bringing about the introduction of this base and surplus plan. This was regarded as a problem at least 4 years before the plan was actually introduced. It seems reasonable that during this 4 years some adjustment resulted, and that the degree of change registered when the plan was actually introduced was somewhat less than if the plan had been introduced when it was first considered. By 1937, the market situation had changed from too much milk in the spring months to a threatened shortage in the fall months. The 1937 report of the association stated that a number of the distributors were compelled to purchase milk from outside sources and expressed concern about the problems arising from temporary supplies in the market. Records of the association for the years 1937 to 1940, inclusive, show there was a consistent effort during these years to strengthen the base and surplus plan. Base adjustments were made toward reaching an adequate amount of base milk to fill market needs in the fall months.

In the meetings of the board of directors during 1940, much attention was given to the pricing plan. The statement was made in the annual report for 1940 that the base and surplus plan had served two purposes in the market: It had leveled out farm deliveries so buyers were supplied on a year around basis, and producers had maintained a greater degree of supervision over surplus milk. A significant point in connection with this statement was the ownership by the association of the Brewster Dairy Products Company which in 1940 had manufactured into dairy products a total of 856,980 pounds of surplus milk delivered by members.

This concluding statement in the discussion forecasts a definite change in the plan. "Under present conditions, it may not be necessary to adhere strictly to our present base plan, but any changes that can be made will have to be done in the light of the importance of a year around supply if producers interests are to be protected in the market on

a long-time basis. Full consideration will be given to this matter at a special meeting of the board of directors which will be held within the near future."

By action later taken by the board, the base plan was abandoned. In its place was substituted a mild form of what has come to be known as the "take off and pay-back plan" to be effective during 1941. Three cents per hundred pounds was deducted from producer payments in April, May and June and two cents in July, August and September. Deductions for the year were $10,463.46. The advisory committee of the association recommended payment of this fund to producers uniformly on shipments during October, November and December.

Influence of the Base Plan on the Seasonal Pattern of Total Milk Deliveries

Total amount of milk delivered to the market by all shippers is an important test of the incentive power of a pricing plan.

Reliable data of the total milk delivered were limited. For the Stark County market, the study is confined to the period 1934-46. Records of the Stark County Milk Producers' Association were used. For the Columbus and Dayton markets, data were available only for the years 1936-1946. For the Columbus market, data pertaining to total milk deliveries were obtained from records of the Ohio Department of Agriculture and the federal milk market administrator's office. Total milk deliveries for the Dayton market were obtained from records of the Miami Valley Cooperative Milk Producers' Association and the federal milk market administrator's office. For the Cincinnati market, records were available for only the 8 years, 1939-1946. These were obtained from the federal milk market administrator of the Cincinnati area. The analysis is limited to an examination and comparison of the seasonal pattern of deliveries during the period of the operation of the base plan and the period following the discontinuance of the plan.

Data presented in Figure 2 indicate the discontinuance of the base plan was followed by a decrease in the ratio of fall-to-spring total deliveries of milk. The three markets, Columbus, Dayton and Stark County, experienced a decrease in the ratio of fall-to-spring deliveries of milk in 1937 as compared to the ratio in 1936. The Columbus and Stark County markets retained the base plan, and in 1938, their ratios increased. The Dayton market discontinued the base plan in the fall of 1937. From this period on, a steady decrease in the ratio followed.

The Stark County market experienced a decrease in the ratio of fall-to-spring milk deliveries following 1938. The ratio for 1939 and 1940 was equal, however, to the ratio in 1936. In the spring of 1941, the Stark County market discontinued the base plan. From this period on, the pattern of a decreasing ratio was similar to the other markets operating free of the base plan.

The Columbus market retained the base plan until 1944. Up to this time, this market had maintained a rather uniform ratio. The uniform ratio in the Columbus market during the period, 1938 through 1943, as contrasted to the downward trend in the ratio during this period for other markets not operating under the base plan, gives support to the assumption that the base plan tended to bring about a more even seasonal pattern of total milk deliveries. Also supporting this assumption is the evidence showing that when the Columbus market discontinued the base plan, the ratio followed the same downward trend as it did in the other markets previously discontinuing the plan.

Influence of Base Plan on Seasonal Pattern of Milk Deliveries of the Average Producer in the Market

Data pertaining to the deliveries of the average shipper in each of the four markets for the period 1927-1936, inclusive, were published in a former study conducted by the Ohio Agricultural Experiment Station.[3] In that study, the method of random sampling was employed in obtaining the amount of milk delivered by the average shipper in the market.

Data pertaining to the deliveries of the average shipper in each of the four markets for the period, 1937 through 1946, were obtained from the same records as were the data pertaining to total milk deliveries in each market. In this latter period, the total amount of milk delivered each month in a given market was divided by the total number of shippers delivering milk during such month to determine the average per shipper.

The amount of milk delivered by the average shipper was discovered to be an unreliable measure to denote the influence a pricing plan might have on the seasonal pattern of milk deliveries. Criticism of this measure is based on the impossibility of determining the amount of milk shipped in the fall months by the same shippers who were in the market during the spring months. Shippers who leave the market will usually do so before the beginning of the fall months. As a general practice, a market will take on new shippers during or preceding the fall months. Thus,

[3]Sherman, R. W. and McBride, C. G. **Ten Years of Farm Sales of Milk in Four Ohio Markets,** Ohio Agricultural Experiment Station, Bulletin 609. December, 1939.

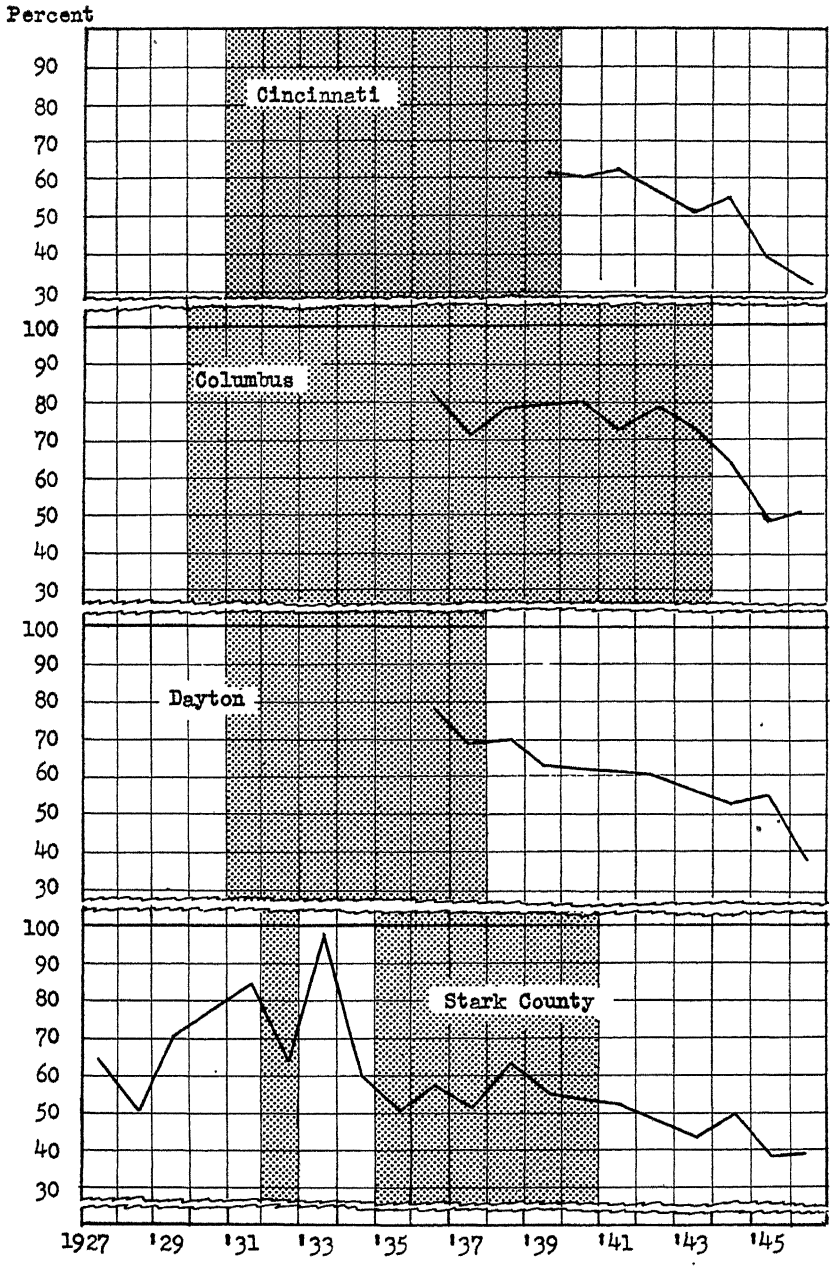

Fig. 2.—Comparison of period of base plan and period of no base plan in percent total market fall delivery is of spring delivery, four Ohio markets, 1927-46.
(Shaded area denotes period of base plan)

daily delivery of milk for the average shipper in the market during the spring months represents one group of shippers, whereas the daily delivery for the average shipper during the fall months represents a differently composed group of shippers. If the base and surplus plan induced a certain group of continuous shippers to change their seasonal pattern of deliveries, it would not be fully reflected by studying the average of all shippers in the market, because the identity of the original group of shippers is lost.

It is assumed the base and surplus plan had little influence on the seasonal pattern of milk deliveries for the average shipper in the market, as indicated in Figure 3. This assumption is based on the finding that all four markets had the same general trend in ratio of fall-to-spring milk deliveries with respect to the average shipper during the 20 years studied even though the base and surplus plan was in operation during different periods of time for each of the markets.

Change of the ratio is more pronounced in the Dayton market than in the other three. During this period, the Dayton market paid substantial bonuses for quantity deliveries to encourage high average daily deliveries per producer. These bonuses were paid without regard to season. Producers made the largest increase in deliveries during the flush months, resulting in a decrease in the ratio of fall-to-spring deliveries. Changes in ratio for the other three markets studied followed closely even though the base plan was not in operation in all markets during the same periods of time.

Influence of Base Plan on Seasonal Pattern of Milk Deliveries of a Group of Shippers Who Delivered Milk Continuously to the Same Market for 20 Years

An analysis was made to determine the influence which the base plan had on the seasonal pattern of milk deliveries for a specific group of shippers who had shipped milk continuously to the same market for at least 20 years. It is significant to note these shippers were delivering milk to the same market before a base plan was introduced, during its operation and after the plan had been discontinued.

For this analysis, a sample of 100 shippers representing the four markets was chosen. Number of shippers to represent each market was determined by the approximate total number of long-time shippers in each market in relation to the approximate total number of long-time shippers in the other three markets. Some adjustment of each market's representative number in the 100-shipper sample was necessary to make

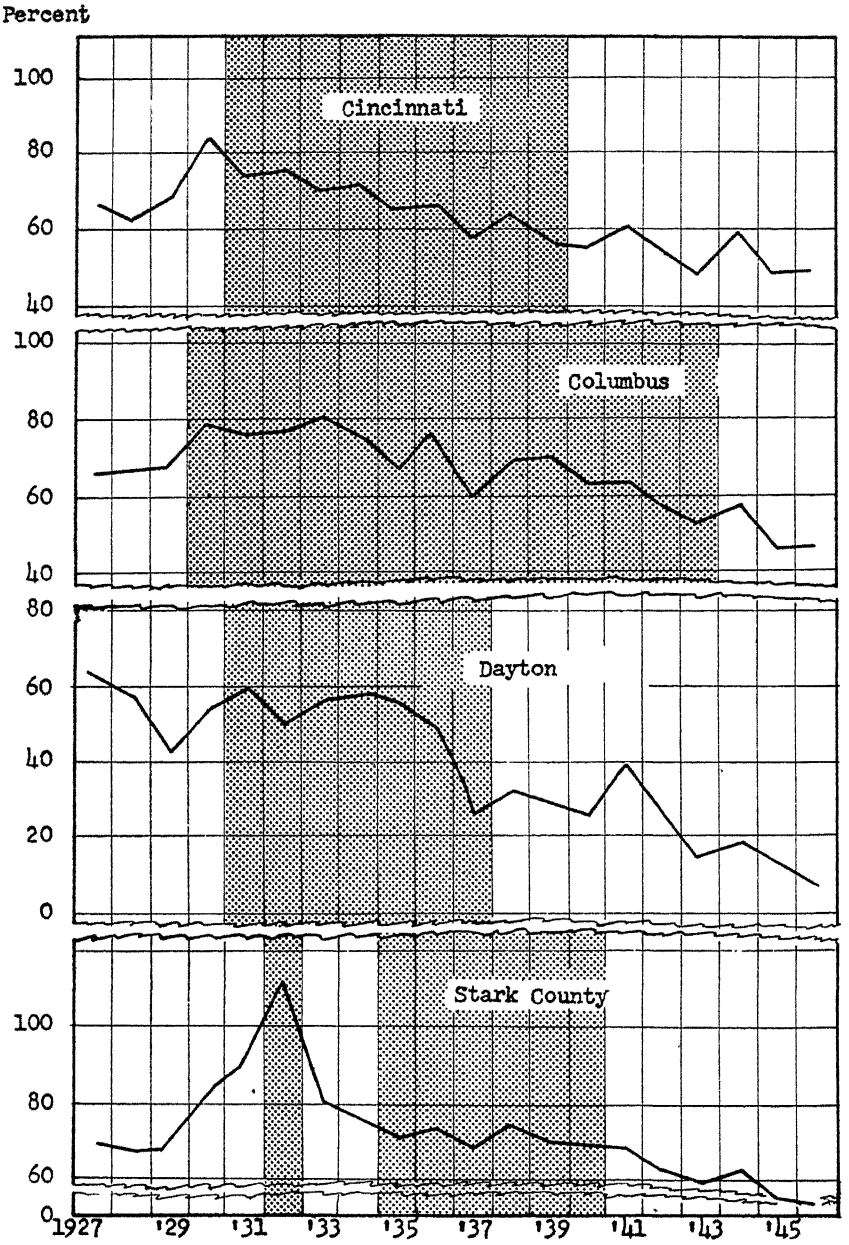

Fig. 3.—Comparison of period of base plan and period of no base plan in percent fall delivery is of spring delivery for the average of all shippers, four Ohio markets, 1927-46.

(Shaded area denotes period of base plan)

the sample obtainable for the individual market more nearly representative of the distribution in amounts of annual deliveries of long-time shippers of such markets, measured by the average annual delivery of milk shipped during the period 1930-1936. This period was chosen because it covered the years during which the base and surplus plan was introduced in the four markets studied.

The Columbus market introduced the plan in 1930 (Fig. 4). The ratio of fall-to-spring milk deliveries for the average of the 20-year shippers registered an immediate increase. The plan should not necessarily be credited with this increased ratio. The other markets studied also experienced an increased ratio for the average of the 20-year producers during the same period of time. It should be noted that the other three markets were not at this time experiencing an introduction of the base plan.

The Cincinnati and Dayton markets introduced the base plan in 1931. The Stark County market introduced the plan for the first time in December, 1931, but dropped the plan 13 months later. It was reintroduced in this market in December, 1934. There is no evidence to show, however, that the plan served as an inducement to all 20-year producers to increase their ratio of fall-to-spring deliveries of milk. As shown in Figure 4, the ratio for the 20-year producers took a drop for the Stark County market in 1935 as compared to 1933, the same as occurred in the Columbus and Dayton markets.

Evidence presented in Figure 4 indicates the discontinuance of the base plan had little influence on the change of seasonal pattern of milk deliveries for the average of the 20-year producers. It is true that a change in seasonal pattern usually did occur at the time the base plan was discontinued for a certain market. It was found, however, that a similar change in the seasonal pattern existed at the same period of time for two or more of the other markets which were not experiencing a similar change in pricing plans.

Comparing averages has been previously criticized in this study. The criticism dealt with comparing the performance of the so-called average shippers in the market. Foundation for the criticism of the previously mentioned type of analysis was that the averages were not always calculated from data representing identical groups of shippers. In the immediate preceding section, an analysis has been conducted by comparing averages. In this case, however, the average was calculated from data representing identical shippers. Still, an analysis dealing with averages, even of the latter type, leaves much valuable information hidden.

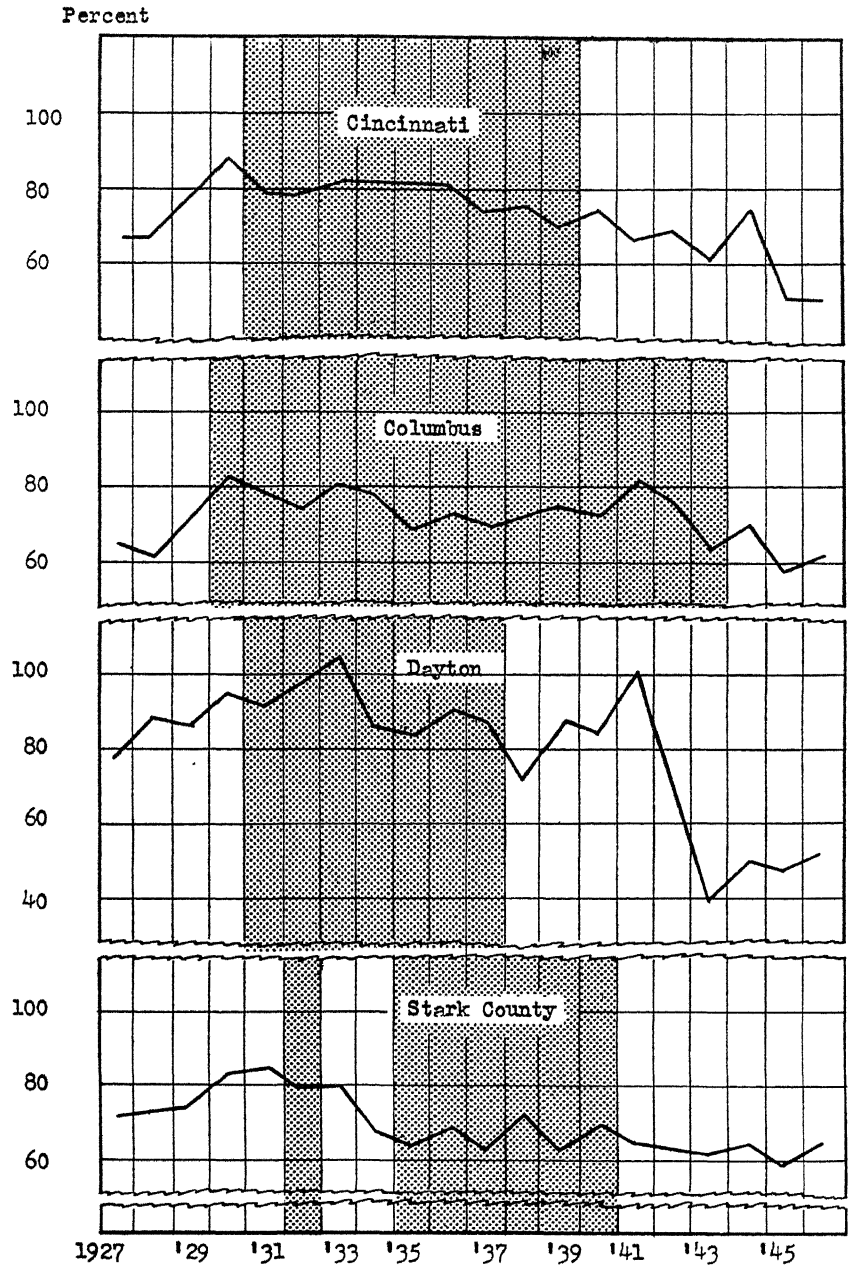

Fig. 4.—Comparison of period of base plan and period of no base plan in percent fall delivery is of spring delivery for the average of 20-year shippers in four Ohio markets, 1927-46.
(Shaded area denotes period of base plan)

The information hidden in the calculation of averages is of the type most needed by those attempting to determine the cause for a change in the seasonal pattern of milk delivered to their markets.

Size of milk shipments will vary in all milk markets. Thus, some shippers in a given market will have a greater influence on the seasonal pattern of milk deliveries than will other shippers. In a study conducted by the Ohio Agricultural Experiment Station,[4] it was found that during the period 1930-1936, 4 percent of the shippers in the Columbus market delivered less than 10,000 pounds of milk each per year. During this same period of time, 7 percent were 100,000-pound shippers. Thus, during the period 1930-1936, some large shippers in the Columbus market were as important as were 10 small shippers. It is possible that 100 small shippers in the Columbus market might have changed their pattern of seasonal deliveries of milk. Ten large shippers might have taken an opposite course. If an analysis of the market were made by employing the use of averages, it could easily appear that no effort had been made by any shipper to change the seasonal pattern of his deliveries.

Degree of influence an individual shipper will have upon the total market's seasonal pattern of delivery will thus be determined by the relative size of his annual shipment. Few shippers will continuously ship the same amount of milk year after year. Thus, during a period of years, an individual shipper will have exerted various degrees of influence upon the total market's seasonal pattern of delivery.

There is significance in the association of changes in size of annual shipments and changes in size of the ratio of fall-to-spring deliveries of an individual shipper during the period of the base plan as contrasted with the period when the plan was not in operation. The following section is concerned with this significance. The delivery records of the 100 20-year shippers were analyzed to obtain this information. The 2,000 annual records were first divided into three groups:

> Annual records reflecting an increase as great as 10 percent in size of delivery from the previous year.
>
> Annual records reflecting a decrease as great as 10 percent in size of delivery from the previous year.
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> Annual records reflecting no change as great as 10 percent either way in the size of delivery from the previous year.

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[4]Ibid.

The 10 percent used to reflect a change in size of annual deliveries was chosen because a change of as much as 10 percent would obviously reflect more than a change caused only by a change in the maturity of the cows milked, or the gradual change resulting from changes in the quality of cows used for herd replacements.

Annual records reflecting an increase as great as 10 percent in size of delivery were then divided into three groups:

Those reflecting an increased ratio of fall-to-spring delivery as great as 5 points, i. e. 40 increased to 45.

Those reflecting a decreased ratio of fall-to-spring delivery as great as 5 points.

Those reflecting no change in ratio as great as 5 points either way.

Annual records reflecting a decrease, and those annual records reflecting no change as great as 10 percent either way in size of delivery were likewise divided into the three change-in-size-of-ratio classification groups.

The amount used to reflect a change in the ratio of fall-to-spring deliveries, 5 points, was chosen because it was felt a change in ratio of this amount reflected a significant effort on the part of the shipper to even out his seasonal pattern of deliveries.

The records of all 20-year shippers indicated no significant difference between the period of the base plan and the period of no plan in the association of changes in size of annual deliveries and changes in size of the ratio of fall-to-spring deliveries. This was determined by employing the use of percentages and by testing the significance of the difference in size of the percentages.

Note that the preceding analysis was concerned with only the direction of change of one factor as compared to the direction of change of the other factor. The important finding is that in the records of all 100 20-year producers, there is no significant difference between the period of the base plan and the period of no base plan in the relative number of times an increase, a decrease, or no change in size of annual delivery will be associated with an increase, a decrease, or no change in the ratio of fall-to-spring deliveries. A finding which may be of equal importance, however, is that a relatively large number of the annual records reflected no change in the size of annual shipment nor a change in the ratio of fall-to-spring delivery.

In further analyzing the influence of pricing plans on the seasonal pattern of milk deliveries of the 20-year shippers, the method of contrasting the distribution of rank of ratio as between the four markets was employed. The delivery records of the 100 20-year shippers were arrayed according to the size of the ratio of fall-to-spring delivery for each year of the period studied.

The array for each year is divided into four groups with 25 records making up each group. Thus, for each year, group 1 consists of the highest 25 ratios; group 2 consists of 25 ratios being next largest; group 3 consists of the next largest 25 ratios, and group 4 consists of the 25 ratios smallest in size.

Identity of the individual shipper in the array of ratios is maintained for each year. It is possible, therefore, to determine the number of shippers from each market in each size of ratio group for any given year.

Actual number of shippers from each market appearing in each of the four rank of ratio groups is of little significance because each market has a different number of shippers in the 100 producer sample. Of importance, however, is the percentage of total shippers in each market appearing in each of the four ratio groups during the period of the base plan's operation as contrasted to the percentage of each market's total shippers appearing in the various classification groups during the period of time when the base plan was not in operation. This expedites an examination of the relative size of the ratios of long-time producers for each market during the period of the base plan as contrasted to the period of no plan.

During the entire period of the base plan, as contrasted with the entire period of no plan, there was a significantly greater percentage of total shippers of the Cincinnati and Dayton markets appearing in the highest ratio group (Table 4). The Stark County market had so few shippers in the highest ratio group during the entire 20 years studied that there is little value in using the market in this particular test. In the Columbus market, there was no significant difference in the percentage of total shippers appearing in the highest ratio group during the period of the base plan as contrasted to the period of no plan. This might be due partly to the fact that there were only 6 of the 20 years when the base plan was not in operation in the Columbus market.

None of the four markets, except Cincinnati, showed a significant difference in the percentages of total shippers of each market appearing in the lowest ratio during the period of the base plan as contrasted to the period of no plan.

There were 5 years when only the Columbus market operated with the base plan. This isolated period of the plan's operation in the Columbus market permits some significant observations regarding the effect of the plan on the seasonal pattern of milk deliveries of 20-year shippers. In the arrangement of shippers by ratio groups, the four markets are set up as being in competition with each other. The most favorable position for a market during the 20 years of the study was that period when such market had the largest percentage of its shippers in the highest ratio group. Another indication of a favorable position for a market would be when such market had the smallest percentage of its shippers in the lowest ratio group.

TABLE 4.—Percentage of Total Shippers of Each Market in Ratio Groups During Periods of Base and Surplus Plan as Compared to Periods When the Plan Was Not in Operation, Four Ohio Markets, 1927-1946

Ratio group	Stark County		Cincinnati		Columbus		Dayton	
	Period of base and surplus plan	Period of no plan	Period of base and surplus plan	Period of no plan	Period of base and surplus plan	Period of no plan	Period of base and surplus plan	Period of no plan
First	12	23	30	25	24	22	38	25
Second	26	31	24	21	25	25	26	37
Third	40	29	26	26	23	24	18	16
Fourth	22	17	20	28	28	29	18	22

When Columbus was the only market operating under the base plan, 26 percent of the 20-year shippers were in the highest ratio group. As a contrast, during the period when the other three markets were also operating under the base plan, only 22 percent of the Columbus 20-year shippers were in the highest ratio group. The test of the significance of the difference of these two percentages indicates that the base plan had an influence on a market's relative number of shippers appearing in the highest group.

Contrasting, and testing for significance, the percentages of Columbus shippers appearing in the lowest ratio group between these two periods, it was found that the base plan had an influence on a market's relative number of ratios of fall-to-spring deliveries of 20-year shippers appearing in the lowest ratio group.

Contrasting the period when Columbus was the sole market operating the base plan with the period when neither Columbus nor the other three markets were operating under the plan, the percentages of the Columbus 20-year shippers appearing in the highest ratio group were 26 for

the first period and 22 for the second period. The test of the significance of the difference between these percentages again indicates that the base plan influenced the market's relative number of ratios appearing in the highest group. An analysis of the relative number of ratios in the lowest group during these two periods also indicates that the base plan had an influence on a market's relative number of ratios appearing in the lowest group.

An examination of the ratio array for each year showed that 14 shippers were in the first ratio group for more than 10 years. In the analysis to follow, these shippers are treated as being consistently high fall shippers.

More than one-third of the highest ratios during the 20-year period of the study was made by these 14 shippers. The introduction or the discontinuance of the base plan had little influence in changing the dominant position of these certain individual shippers in regard to a high-fall delivery performance.

Table 5 indicates there is little difference in the size of annual delivery for these consistently high-fall shippers, between the period of the base plan and the period of no base plan. There is little difference between the two periods in the actual size of the ratio of fall-to-spring deliveries, and no significant difference between the two periods in the association of size of annual delivery and the ratio of fall-to-spring delivery. This is to say that a certain size of annual delivery was associated with the same ratio during the period of no base plan as was true during the period when the base plan was in operation. On the basis of these facts, there is a high degree of consistency in the amount of milk delivered annually and the seasonal pattern of delivery for the high-fall shippers in the market. Furthermore, the base plan had little effect on these shippers.

Ratio array for each year shows that 13 shippers were in the lowest ratio group for more than 10 years. In the analysis to follow, these shippers are treated as being consistently low fall shippers. Examination of the change in the relative size of their ratios shows there is no indication that a change in the pricing plan is associated with the relative size of ratios for the low fall shippers. The relatively low fall shipper remained as a low shipper in a given market regardless of whether the base plan was in operation.

Examination of the actual size of the ratio of fall-to-spring deliveries of the consistently low fall shippers reveals in the Cincinnati market little difference between the period of the base plan and the period when the plan was not in operation (Figure 5). The Columbus market does not

offer a good case study in this particular section of the analysis because there were only 6 years when the base plan was not in operation. It is of significance, however, that in both the Columbus and Cincinnati markets, the relative low-fall shipper delivered approximately the same amount of milk per year during the period of the base plan as he did during the period when the plan was not in operation.

TABLE 5.—Number of Individual Annual Shipments by Size of Annual Average Daily Pounds Delivered and Percent Fall Delivery is of Spring Delivery, High-Fall Shippers, Combined Four Ohio Markets, 1927-1946.

Pounds	Period	Percent fall delivery is of spring delivery									Total
		0 to 20	21 to 40	41 to 60	61 to 80	81 to 100	101 to 120	121 to 140	141 to 160	161 to 180	
550	Of plan	1			1		1	1			4
501	No plan								1		1
500	Of plan		1		1						2
451	No plan					1					1
450	Of plan	1			1		1				3
401	No plan				1		1				2
400	Of plan				1			1			2
351	No plan							1			1
350	Of plan			1	2	3	3	2			11
301	No plan					3	4	1		1	9
300	Of plan		1	2	2	5	6	7	2		25
251	No plan				3	7	8	4	3	1	26
250	Of plan			3	4	9	4	3			23
201	No plan		2	2	6	8	4	2	2	1	27
200	Of plan		1	2	2	12	6	1			24
151	No plan		1		2	10	6		2	1	22
150	Of plan			1	7	10	5	2	1	1	27
101	No plan		1	1	3	15	5	3	1		29
100	Of plan			1	3	8	4	2			18
51	No plan		1			9	8	2			20
50	Of plan										0
0	No plan										0
Total	Of plan	2	3	10	24	47	30	19	3	1	139
	No plan		5	3	15	53	36	13	9	4	138

Further measure of the influence the base plan had on the seasonal pattern of milk deliveries was made by analyzing records of the 20-year shippers who had consistently been in the middle ratio groups. In the analysis to follow, these 20-year shippers will be treated as the consistently middle ratio group.

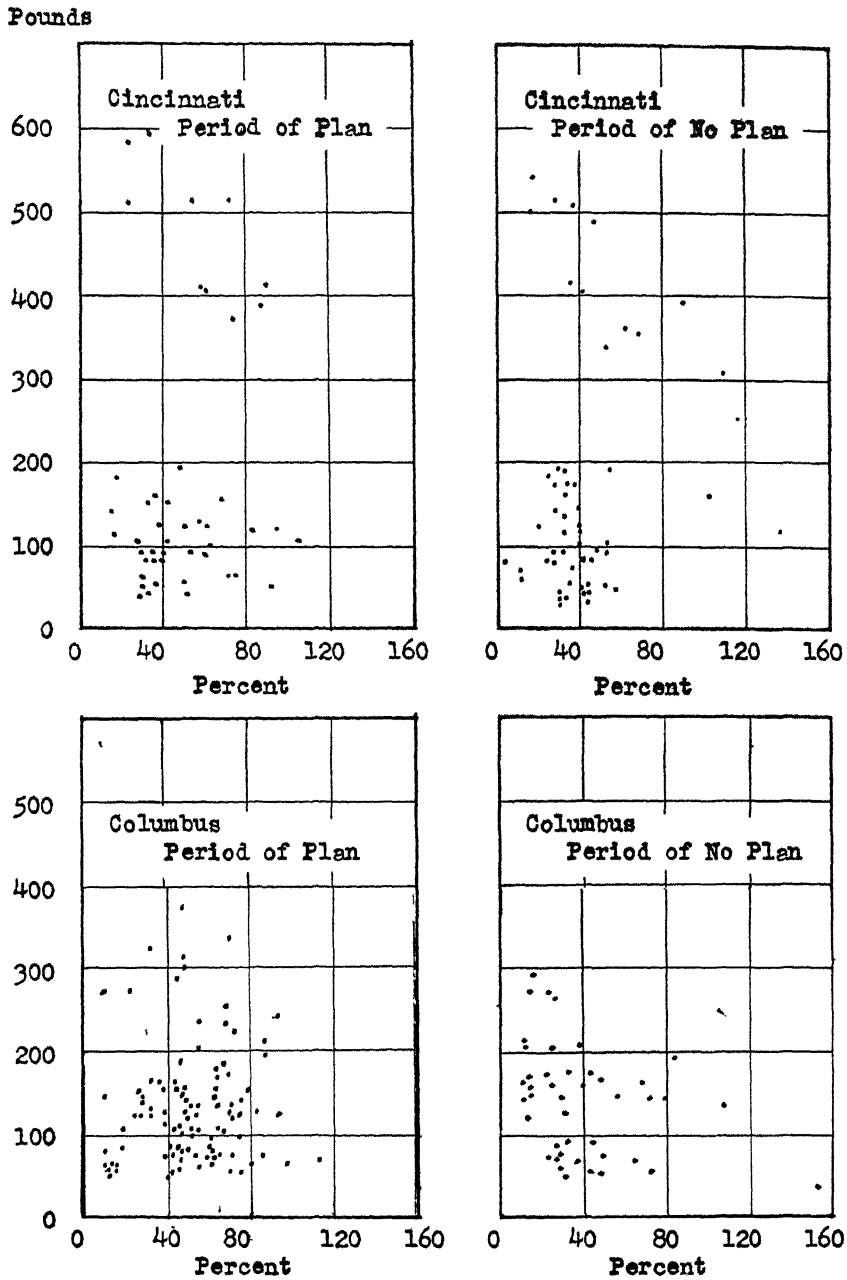


Fig. 5.—Comparison of period of base plan and period of no base plan in relationship of annual average daily pounds delivered and percentage fall delivery is of spring delivery for consistently low fall 20-year shippers, two Ohio markets, 1927-1946.

In the Cincinnati, Columbus and Stark County markets the average annual daily delivery of the middle ratio group of shippers was significantly larger during the period of the base plan than when the plan was not in operation (Table 6). In the Dayton market, there was no significant difference between the two periods in the size of average annual deliveries for this group of shippers.

TABLE 6.—Average Annual Daily Delivery for the Consistently Middle Ratio Group of Shippers. Four Ohio Markets. 1927-1946.

Market	Average Annual Daily Pounds Delivered	
	Period of Base Plan	Period of No Plan
Cincinnati	163	140
Columbus	226	192
Dayton	79	77
Stark County	223	212

Average fall-to-spring ratio of milk deliveries was significantly larger during the period of the base plan than with the period of no plan for the middle ratio group of 20-year shippers in the Cincinnati, Columbus and Stark County markets. In the Dayton market, there was no significant difference in the average ratio for this particular group of shippers between the two periods (Table 7).

TABLE 7.—Ratio of Fall-to-Spring Deliveries for the Consistently Middle Ratio Group of Shippers. Four Ohio Markets. 1927-1946.

Market	Period of Base Plan	Period of No Plan
Cincinnati	81.4	65.3
Columbus	78.9	63.9
Dayton	77.9	76.5
Stark County	74.5	71.2

Examination of the seasonal performance of the middle ratio group of 20-year shippers indicated in none of the four markets a significant difference in the degree of association of changes in the ratio of fall-to-spring milk deliveries (Fig. 6). In the Cincinnati and Columbus markets, however, an increase in the average size of annual delivery of this group of shippers was associated with an increased ratio during the period of the base plan, whereas, during the period of no plan an increased average annual daily delivery was associated with a decreased ratio. In the Stark County market, an increase in the average annual

daily delivery for this group of shippers was associated with an increased ratio during both periods; however, the increase in the ratio was slightly larger in the period of the base plan than with the period of no plan.

In the Dayton market, an increase in the average annual daily delivery of this group of shippers was associated with a slightly decreased ratio during the period of the base plan, whereas during the period of no plan, an increased average annual daily delivery was associated with an increased ratio. In the Dayton market, a quantity bonus was introduced shortly after the base plan was discontinued. The quantity bonus and

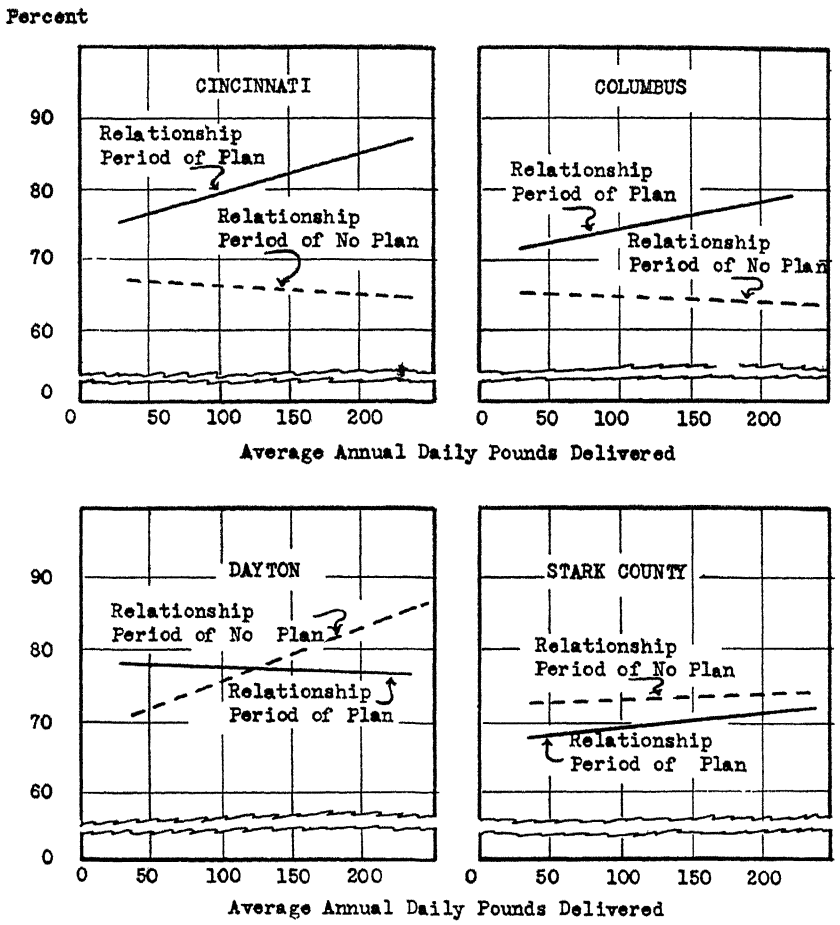


Fig. 6.—Comparison of period of base plan and period of no base plan in relationship of changes in annual average daily pounds delivered and changes in percent fall delivery is of spring delivery for consistently middle ratio 20-year shippers, four Ohio markets, 1927-46.

other methods of increasing the total supply of milk in the Dayton market following 1940 would tend to induce a more intensive dairy farm enterprise. It is reasonable to believe that this more intensive type of dairy enterprise was an influencing factor in changing the seasonal pattern of milk deliveries of the consistently middle ratio group of shippers in this market after the discontinuance of the base plan. This may account for the Dayton market differing from the other three markets in this test.

Shipper Opinion about Price Plans

Introduction of a seasonal pricing plan generally is considered as being the result of a democratic process. It is assumed that the plan would not be in operation unless it was approved by a majority of the shippers in the market. The democratic process of establishing a plan does not necessarily insure success of such plan. As previously explained, there often is a wide variation in the amount of milk delivered by individual shippers in a market. The relative amount of milk delivered by each shipper determines the relative influence which each shipper has on the seasonal pattern of milk deliveries for the entire market. If a pricing plan were on the borderline of being successful, the seasonal performance of a relatively few large shippers could cause the plan to be successful or unsuccessful.

In addition to the study of 100 delivery records in the four markets, some 20-year shippers in the Columbus and Stark County markets were interviewed. One purpose of the interview was to ascertain the attitude of the shipper to the base plan and then to compare the expressed attitude with the actual performance of the individual shipper. It was believed that this type of an analysis would yield information of significance relating to the degree of compliance associated with favor toward or opposition to a price plan. Supplementary questions were used in the interview-schedule to ascertain the individual shipper's method of changing his seasonal pattern of delivery.

As previously stated, the base plan was initiated in these markets to reduce the amount of milk delivered during the spring months. There is little evidence that during the early 1930's there was a general need for the shifting of spring production to fall production. It might be said the market needed less milk in the spring, but approximately the same fall supply. Therefore, the market actually needed an annual supply of milk reduced by the amount of the burdensome surplus of the spring months.

On the average, the Columbus shippers favoring the base plan were those reducing the size of their annual average daily shipments during the early years of the plan's operation. This might indicate that the shippers of the Columbus market in favor of the previous base plan were cooperating with the early purpose of the plan to the extent of reducing their annual deliveries. This performance was a noticeable contrast (Fig. 7) to the performance of those 20-year shippers who expressed opposition to the base plan. Throughout the period, the 20-year shippers who expressed opposition to the base plan were increasing the size of their annual average daily deliveries.

There is a reason why shippers in the process of reducing their annual shipments would be more likely to favor the base plan than would shippers attempting to increase. This would be true because a base allotment is generally calculated from records of delivery of the previous year. Thus, a shipper who was shipping less milk during one year than he had shipped the previous year would probably find that the base allotment calculated from the higher previous annual delivery would be sufficient to cover more of the milk he shipped during the year of smaller annual shipment. On the other hand, a shipper who was attempting to enlarge his dairy enterprise usually would find a larger amount of his increased shipments would not be covered by the base allotment determined on the basis of previous yearly data. Under such circumstance, a shipper with expanding volume would be opposed to the plan.

The Stark County market re-introduced the base plan approximately 5 years after the initial introduction of the plan in the Columbus market. During this 5-year period, there had been a noticeable recovery in general economic conditions from the depression of the early 1930's. Purpose of the base plan, at this latter date, was actually to transfer some of the spring deliveries into the fall months rather than to reduce the annual total by the amount which was surplus during the spring months.

In the Stark County market it is also true, as shown in Figure 7, that 20-year shippers not in favor of the previous base plan were on the average shippers attempting to increase their dairy enterprise. The shippers in favor of the plan were, on the average, shipping more nearly the same amount of milk each year of the base plan's operation.

Of significance for those responsible for the administration of a base plan is information concerning the relative degree of compliance by shippers favoring the plan as contrasted to that by shippers opposing the plan. In this sample, the seasonal deliveries of shippers who expressed opposition to the base plan quite often matched the pattern of deliveries of those shippers who expressed favor toward it.

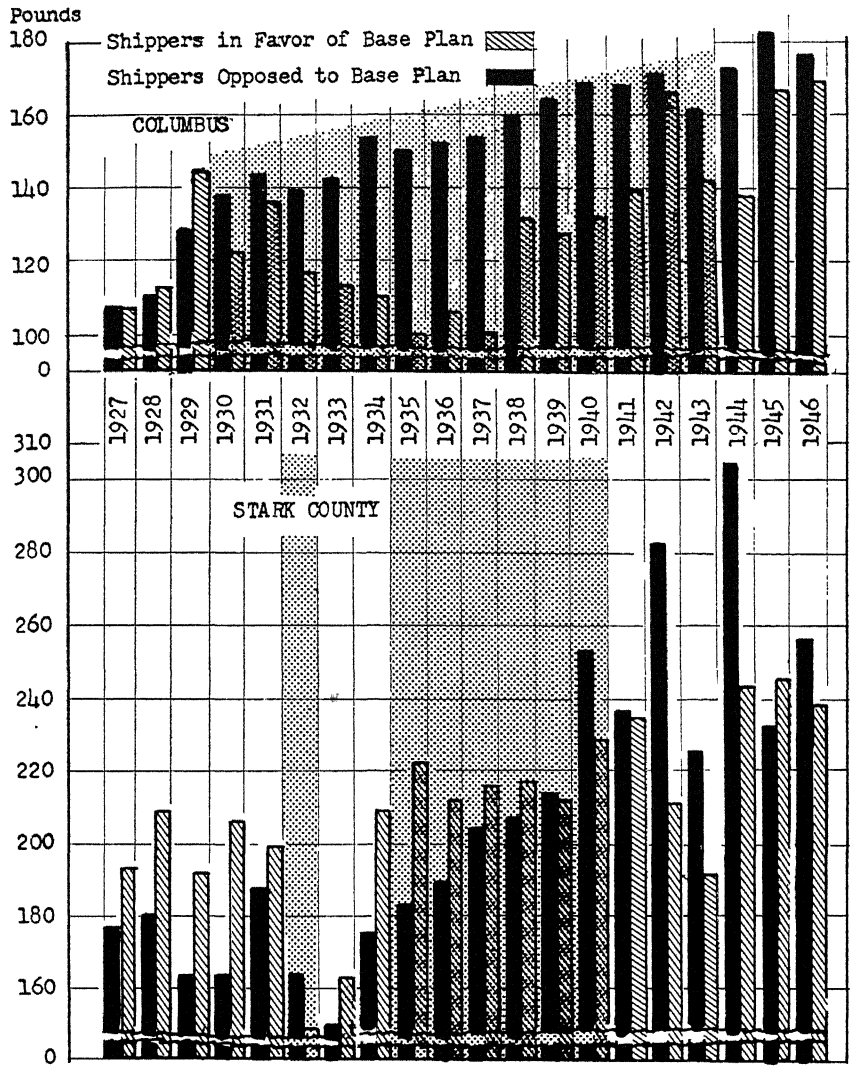
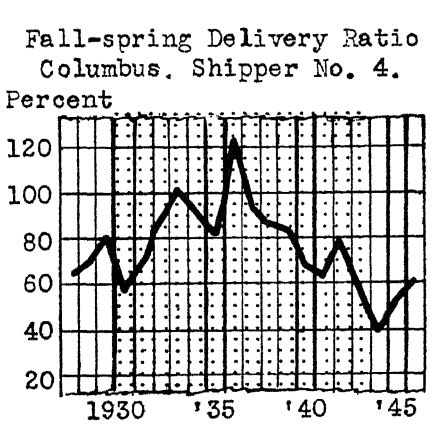
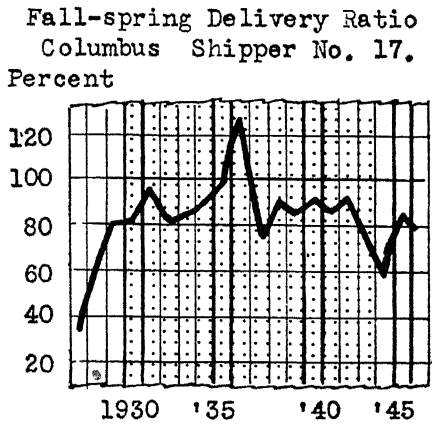


Fig. 7.—Comparison of period of base plan and period of no base plan in annual average daily pounds delivered by 20-year shippers who favored the base plan and 20-year shippers who were opposed to the base plan, two Ohio markets, 1927-46.

(Shaded area denotes period of base plan)

Below are given synopses of interviews conducted in the Columbus and Stark County markets. Each summary is accompanied by a chart showing the fall-to-spring delivery ratio of the producer interviewed. Most significant conclusion to be drawn from these interviews is the diversity both of dairy production practices and opinion with respect to marketing plans. The interviews were taken in March, 1948, and the opinions expressed as to need of change in price plans are based upon conditions as of that date.



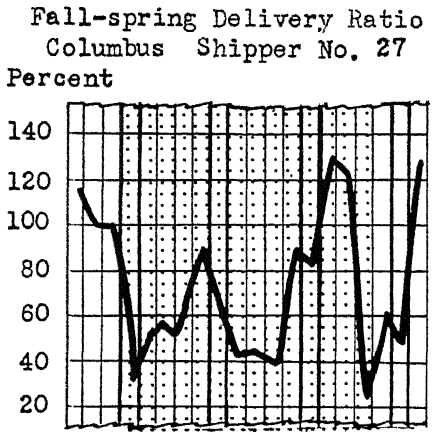


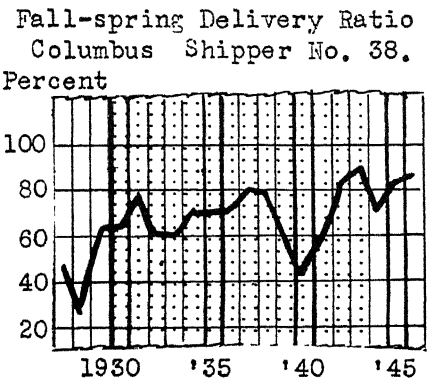
Columbus Shipper No. 4.—Believed that base plan was needed in order to bring about a more even seasonal pattern of milk deliveries. His adjustment to the plan when in effect was by breeding rather than feeding.

Columbus Shipper No. 17.—Could see no good points in base and surplus plan. He claimed base in Columbus was not set according to market needs. He believed that season differentials applied to milk prices would solve seasonality problem. His pattern was influenced by buying and selling cows in milk. Had introduced milking machines recently and increased his volume.

The reasons given in support of their attitude toward the base plan were in some cases contrary to the actual performance of the individual. Examination of the reasons given and of the seasonal performance of the individual shipper who expressed each type of reason indicates that a strong educational program is needed for the successful operation of the base plan.

Answer to the question of whether there was a need for some type of incentive pricing plan in March, 1948, was negative for about three-fourths of the shippers interviewed. About one-half of the shippers who



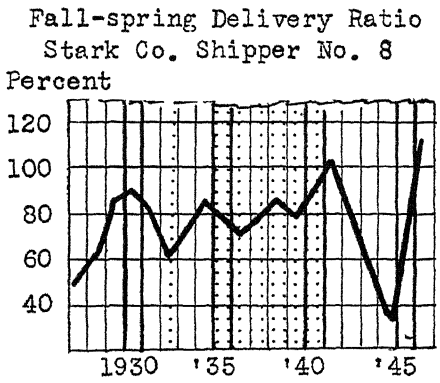


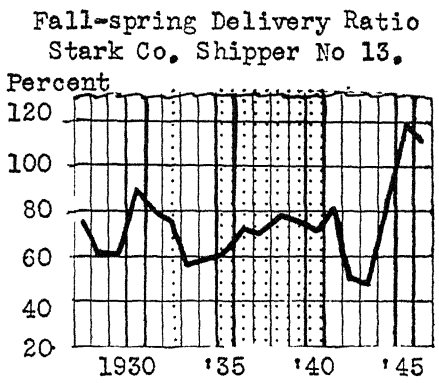
Columbus Shipper No. 27.—Was not in favor of base plan. He had not been able to keep deliveries anywhere near his allotted base. He believed that bonus for fall production would be better than a base plan and stated he would leave the market if base plan were again introduced.

Columbus Shipper No. 38.—This shipper was in favor of the base surplus plan, and when interviewed in March 1948 recommended a return to a base plan if and when spring surplus becomes a problem. He believed that the plan when in operation held up the spring price of milk. It also put responsibility for a sound market supply situation upon the producer. This farmer adjusted his shipments to the plan by breeding.

saw no need of a pricing plan in 1948 were of the opinion, however, that there was a definite need for a greater differential in the price of spring and fall milk. The base plan is the only pricing plan which had been generally recognized in these two markets as an attempt to even out seasonal deliveries including the year 1946. There were, however, in the subsidies initiated in September, 1943, and ended in June, 1946, a definite seasonal price pattern. Furthermore, class I and II prices in both markets during 1946 and 1947 were higher in the fall and winter than in spring and summer.

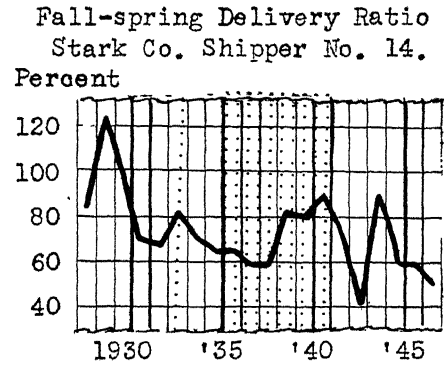
Analysis of the attitude of these longtime shippers to the need for a pricing plan at present and their respective attitude toward the base plan as it had previously operated in these two markets revealed that approximately one-half of shippers who had been in favor of the plan were against its reintroduction. This also was true of the shippers who were in disfavor of the previous plan. Shippers favoring reestablishment of

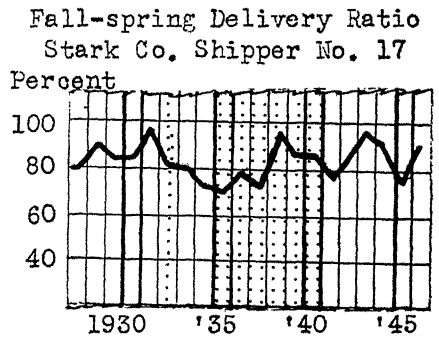




Stark County Shipper No. 8.—Was in favor of base plan. Had lost his entire herd from TB in 1925 and had been influenced by the plan in rebuilding. He believed some incentive plan was needed but felt that several shippers should have special consideration. He thought surplus would soon again become a problem and would favor trying take-off and pay-back plan in his market.

Stark County Shipper No. 13.—Was in favor of the base plan. He had increased annual production by increasing number of cows and adjusted to the plan by breeding and heavier fall feeding. He believed the base plan forced production of more fall milk. Believed there was a need for wider seasonal price differentials. Commented that base plan caused hard feelings toward the cooperative leaders.





Stark County Shipper No. 14.—Was not in favor of the base plan. He did not think plan succeeded in adjusting supply to demand in the market. He believed producer should be allowed to find a market for his own surplus. At the time he was interviewed he did not believe there was any need for a plan in the market.

Stark County Shipper No. 17.—Was not in favor of the base plan. He believed a man would have to buy and sell cows in milk to fit in with a base plan. He did, however, believe that some incentive plan was needed and was inclined to favor the take-off and pay-back plan.

the base plan realized the difficulty which owners of six- to eight-cow herds have in carrying out a breeding program to fit in with the base plan. Shippers in favor of the previous plan also said they wanted a substantial difference between the prices of spring and fall milk. Yet they did not believe there was need for the introduction of a pricing plan to bring about a more even seasonal pattern of milk deliveries. This fact is significant.

SUMMARY AND CONCLUSIONS

This bulletin covers two research projects dealing with seasonality of milk deliveries from farms. One was a study of trends in size and seasonality of deliveries in 10 Ohio markets and Chicago in the 10-year period, 1935-44. The other was a more comprehensive analysis of the delivery of milk from farms in four Ohio markets, Cincinnati, Columbus, Dayton and Stark County.

In the study of 10 markets, from 1935 to 1944, Akron had the greatest increase in size of deliveries with 75.4 percent and Youngstown the smallest with 27.8 percent.

Computation of seasonal indices indicated there was a much wider range of these indices in June than in November. Seasonality became greater during the period, with most of the change being caused by increasing deliveries in the spring months. From 1941 to 1944, the markets would have benefited by the opposite—an increase in fall deliveries in relation to those of the spring months.

The most intensive statistical analysis covered in the study was that of deliveries in four Ohio markets for the years 1927-1946. During the early 1930's, the seasonal problem in milk marketing grew out of a burdensome supply during the flush period. The problem later concerned the matter of fall deficit.

Conditions bringing forth the introduction or discontinuance of a pricing plan usually exist a period of time prior to the actual introduction or discontinuance of the plan. During this waiting period, the conditions, themselves, force a certain degree of adjustment. This reduces the degree of change actually taking place immediately following action of introducing or discontinuing the plan.

Ratio of fall-to-spring total milk deliveries in the four markets studied decreased when the base and surplus plan was discontinued. Those markets retaining the base plan did not experience a similar decrease in the ratio.

Average of all shippers in the market is an unreliable measure for judging influence of the base plan on seasonal pattern of milk deliveries from Ohio farms, because the average is influenced both by a change in the total pounds delivered and a change in the number of shippers making the deliveries. Introduction or discontinuance of the base plan could not be credited with changing the ratio of fall-to-spring milk deliveries for the average of all shippers in the respective markets.

An analysis was made of the seasonal pattern of milk deliveries of a sample of 100 shippers who had continuously delivered milk to the same market before, during and after the period of the base plan.

There was no significant change in the ratio of fall-to-spring deliveries during the period of the base plan for the average of the 20-year shippers in the four markets studied. An analysis dealing with averages, even of the latter type, leaves much valuable information hidden.

Size of milk deliveries showed a wide range. Some shippers in a given market had a greater influence on the seasonal pattern of milk deliveries than did other shippers.

Size of annual average daily delivery was not a significant indication that an individual shipper's ratio of fall-to-spring milk deliveries would be high or low. This was also true of the period of the base plan and the period of no plan.

In each market studied, there was a group of individuals who were consistently high fall shippers and a group of consistently low fall shippers. The high fall shipper tended to continue as a high fall shipper with or without the benefits of the base plan. The low fall shipper tended to continue as a low fall shipper with or without the penalties of the base plan.

In the consistently high fall and the low fall shippers, there was no significant contrast between the periods of the plan and of the no plan in the association of changes in size of annual average daily delivery and size of the ratio of fall-to-spring milk deliveries.

In the 20-year shippers in the Cincinnati, Columbus, and Stark County markets who were not consistently high, nor consistently low fall shippers, an increase in the size of the annual average daily delivery during the period of the base plan was followed by an increase in the size of the ratio of fall-to-spring milk deliveries. During the period of no plan, an increase in the size of annual average daily delivery was followed by a decrease in the size of the ratio of fall-to-spring milk deliveries. The Dayton market differed from the other three markets in this analysis.

In this market, a quantity bonus was introduced shortly after the discontinuance of the base plan. The quantity bonus brought about a greater degree of intensity in dairy farming. The contrast in the changing degree of intensity of dairying largely explains why the Dayton market differed from the other three markets.

During the period of the base plan, the individuals who were consistently middle ratio shippers increased their annual deliveries of milk. Thus, during this period, this group of shippers were exerting a relatively greater influence on the market's seasonal pattern of milk deliveries than was true of the period when the plan was not in operation. Also during the period of the base plan, this middle ratio group of shippers increased their ratio of fall-to-spring delivery of milk. This group of shippers was influenced by the price incentive of the base plan, and, as a result of their behavior, the total deliveries in the market followed a more even seasonal pattern during the operation of the plan.

Many shippers opposing the base surplus plan state that nature is against the plan. Some shippers expressing favor toward the base plan as used in these markets implied they would be willing to accept another type of plan if generally approved by the leadership of their cooperative association.

On the average, individuals attempting to increase the volume of milk deliveries were inclined to express opposition to the plan. Shippers expressing favor toward the plan were on the average holding constant or actually reducing the volume of their deliveries. This was significant in a period when the market was demanding a greater total supply of milk because then every encouragement was needed to induce farmers to increase the amount of milk delivered.

The base plan is an effective means of bringing about a more uniform seasonal pattern of total milk deliveries for a market. No major Ohio milk market has retained the base plan, however, during a period when there was a continuous heavy demand for an increase in the supply of milk in the market.